Article

SEXUALITIES

Abstract This article introduces chimerism and mosaicism as two recent scientific 'discoveries' that present challenges to western heteronormative notions of kinship. Chimerism, in the form of xenotransplantation, already demands a rethinking of traditional boundaries between what is considered 'kin' and 'non-kin'. Recent biological studies describing chimerism as two genetically distinct cell lines in one organism not caused by transplantation, invites further questions regarding the stability of kinship ideology. The aim of the article is to argue, with anthropologists and feminist science studies scholars, that the western understanding of kinship relies upon a problematic use of 'nature', and that this dependence necessarily produces shifting and contradictory definitions of kinship.

Keywords chimerism, kinship, mosaicism, reproductive technologies, sexual difference

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Chimerism, Mosaicism and the Cultural Construction of Kinship

> If, as David Schneider observed of American culture, new facts of biology are new facts of kinship, it is hardly surprising that the genetic discoveries occurring on a nearly weekly basis must be seen to produce new cultural forms, too. (Marks, 2001: 379)

Introduction

It is the 1930s and black, working-class Joe Youngblood is trying to organize Crossroads, Georgia's first labour union. So begins John Oliver Killens's novel, *Youngblood* (1954). The story concerns the mobilization of the National Association for the Advancement of Colored People (NAACP) in the USA. In the early days of what became the Civil Rights Movement, the NAACP attempted to organize labour unions across racial boundaries. Joe Youngblood is shot by a white supervisor when Joe

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challenges the unfairly low wages he has received from his white boss. The tension quickens when Joe is refused treatment at the hospital, and word spreads around town that Joe is seriously wounded. The town's only black doctor sets to work on Joe, organizing the blood transfusions required for surgery. The full force of the novel emerges in its depiction of the moral panic of American society surrounding race. None of Joe's 'blood kin' share his type O blood. A compatible black man is found and provides the first transfusion. Meanwhile, in the poor white part of town, white working class Oscar Jefferson learns of Joe's misfortune. Oscar works with Joe and shares his desire to form a union, but Oscar is also steeped in the racial prejudice of the white community. Oscar and his son make their way to the black section of town. The black men protecting the area from Ku Klux Klan terrorization allow Oscar to enter on the condition that he donate blood to Joe. A painful deliberation takes place as Oscar vacillates between prejudice and good will. His eventual relief that his blood type does not match is quickly truncated upon learning that his son's blood type is compatible. The picture on the front jacket of the book illustrates what Kath Weston describes as the 'intimacy' of the blood transfusion between Joe and Oscar's son (2001: 157).

The 'mixing' of Joe and Oscar Junior's blood invokes other forms of 'mixing' resonant during the 1950s in America – 'mixed' marriage between black and white people for instance. The compelling account of the sharing of 'mixed race' blood in *Youngblood* not only calls upon powerful cultural symbols and representations of race and ethnicity, but also upon notions of kinship and identity. Oscar struggles between his 'blood kinship' with his son Junior, his 'race kinship' with white people and his 'class kinship' with Joe. When the black men protecting their part of town from the Ku Klux Klan offer Oscar admittance on condition that he donate blood, they are as troubled by the thought of 'contaminating' racial blood lines as Oscar. One character asks 'Is white blood any different from colored?' and 'Do white blood mix with colored?' to which the doctor replies, 'There's no white blood and there's no black blood . . . All blood is red-blooded. The only difference is in the different types' (1954: 460).

The doctor's reply is based upon knowledge of the biology of blood, and provides the 'rationality' of science familiar to contemporary readers. But one of the great strengths of the book is to illustrate that notions of 'biology' are always imbued with culture. Just as the doctor's assurance that 'blood is blood' does little to allay the moral panic experienced by Oscar, the black men attending Joe, and the Ku Klux Klan mob on their heels, contemporary analyses of the evolutionary heritage of blood (biology) has not necessarily done anything to allay the prejudices of people still concerned with maintaining racial 'purity'. For instance, Cann, Stoneking and Wilson's (1987) analysis of mitochrondrial DNA found

that Africans are more genetically diverse than both Europeans and Asians, and subsume the genetic diversity found in the rest of the world: genetically speaking, Europeans are an admixture of 65 per cent Chinese and 35 per cent African. None the less, history is replete with examples of the creation of structures of exclusion in response to perceived threats to the cultural distinctions between peoples (Weston, 2001).

Perhaps the strongest structure of exclusion (and, by definition, inclusion) is kinship. Donna Haraway's definition of kinship, as 'a technology for producing the material and semiotic effect of natural relationship, of shared kind' (1997: 53) reinforces the dependence of notions of kinship on culture rather than nature. *Youngblood* serves to highlight the refraction of biological assumptions about 'blood kinship' through cultural (in this case racial) notions of 'blood kinship'. Much recent work in feminist studies of science, and the sociology of science more generally, has expanded analyses of the ways in which culture assimilates biological notions of kinship, for instance in studies of reproductive technologies (Donchin, 1989; Franklin, 1997, 2001), the Visible Human Project (Waldby, 1999), animal studies (Haraway, 1989, 1997) and intersex (Fausto-Sterling, 2000; Hird, 2003a, b).

Chimerism is most familiarly known within the xenotransplantation literature as the transplantation of animal organs into humans. In this article I want to introduce a more recent way in which chimerism has entered scientific discussion (Bird et al., 1982; Strain et al., 1995; Strain et al., 1998; Van Dijk et al., 1996; Nelson, 2002; Neng et al., 2002; Pearson, 2002). In recent biological studies, chimerism refers to the presence of two genetically distinct cell lines in an organism. This may occur through inheritance, transplantation or transfusion. Mosaicism is more common than chimerism and refers to patches of tissue that differ genetically. Once assumed to be a rarity, recent research (for example Van Dijk et al., 1996) suggests that as many as 4 per cent of twins and 14 per cent of triplet individuals are chimeras, as well as a yet unknown incidence within the general population (one does not need to be born as a multiple birth – chimerism may occur because of an embryo 'that died early in gestation and was spontaneously aborted' (Pearson, 2002: 10). In this article I aim to argue that both chimerism, as xenotransplantation, and the more recent 'discovery' of chimerism as cell and gene transfer, incite intriguing analyses of kinship. What is interesting for me is that just as *Youngblood* exemplifies the biological *commonality* of human animals despite cultural divisions along racial lines, chimerism as xenotransplantation extends the notion of kinship to include non-human animals as well. On the other hand, chimerism and mosaicism within the new biological literature offer the opposite – to twist traditional understandings of 'blood' and genetic relations such that a mother may not be 'blood' related to the

children that she gives birth to, and individuals may share germ cell lines with never-living siblings. In this analysis I want to argue a point that Marilyn Strathern (1992) has made, that nature does not provide a sufficient model for the cultural context of kinship. I will suggest chimerism and mosaicism may serve to remind us that our cultural conceptions of what kinship means, and what biology 'says' are neither transparent or immutable.

I want to make this argument particularly with respect to heteronormativity. Western notions of kinship are strongly imbued with heteronormativity. Indeed, developments in bio-technology may have expanded reproductive choices, but at the same time the contemporary focus on genetics has become incorporated into commonsense stories of 'who we are' such that demands are made to know the identity of sperm and egg donors – who the 'real' mothers and fathers are.[1] In this way, kinship is understood culturally in terms of specific ideas about biology, which assimilates people's identity narratives within a heteronormative framework. Chimerism and mosaicism challenge this heteronormative matrix in important ways by severing links between biological 'truth' and commonsense notions of kinship. Therefore, this article will assess just how far the notion of kinship might be stretched.

All in the family

Kinship is most often defined within the context of traditional western heteronormative society. Within this structure, kin is dichotomous – either blood or non-blood relations. Blood relations are assumed to share biological substance including genes and blood. The study of kinship has been one of the great mainstays of anthropology, and during the heyday of the anthropological tradition of extensive ethnographic study of non-western cultures, anthropologists discovered that some cultures used classificatory 'blood' kinship terms that did not correspond to what were thought by Euro-North American anthropologists to be 'true' genetic relationships (that is, biological). Trobriand Islanders and Aboriginals of Australia, for instance, deployed a complex system of relations to define 'kin', some based on what Euro-North American anthropologists recognized as 'blood relations', and some based on 'non-blood relations'. In effect, Trobriand Island and Aboriginal systems of kinship challenged Euro-North American assumptions about the consanguinity of kinship. As Franklin observes, 'it was a perception that derived from the European scientific assumption that kinship categories should be read directly from "blood" ties as a matter of commonsense, and that to do otherwise could only be interpreted as ignorance of paternity, or general lack of intellectual development' (1997: 22). In his famous studies of the

Trobriand Islanders, for instance, Bronislaw Malinowski argued, 'it seems hardly necessary to emphasize that for physiological consanguinity as such, pure and simple, there is no room in sociological science' (1913: 177fn.).

In contrast, David Schneider sought to analyse the ways in which American culture has become increasingly dependent upon notions of biology. In his path-breaking work on kinship in *American Kinship: A Cultural Account* (1980[1968]), Schneider offers a sustained account of the complex relationship between biology and kinship. Just 12 years later the hegemony of biology had become such that, in the second edition of the book, Schneider is able to argue that:

> In American cultural conception, kinship is defined as biogenetic. This definition says that kinship is whatever the biogenetic relationship is. If science discovers new facts about biogenetic relationship, then that is what kinship is and was all along. (1980[1968]: 23)

In so far as Schneider argued that biology has no meaning outside of cultural context, he highlighted the particular contradictions of Euro-North American understandings of kinship. Schneider argues:

> The relationship between man [sic] and nature in American culture is an active one . . . Man's place is to dominate nature, to control it, to use nature's powers for his own ends . . . In American culture man's fate is seen as one which follows the injunction Master Nature! . . . But at home things are different. Where kinship and the family are concerned, American culture appears to turn things topsy-turvy . . . What is out there in Nature, say the definitions of American culture, is what kinship is . . . To be otherwise is unnatural, artificial, contrary to nature. (1980[1968]: 107)

Schneider's work has been the subject of critical analyses that have pointed out, for instance, that it relies upon a distinction between 'cultural facts' and 'biological facts' at the same time that it seeks to expose this distinction in other anthropological work (Franklin, 1997). Nevertheless, Schneider's focus on heterosexual coitus as central to the 'symbolic universe' of American kinship has been taken up within contemporary lesbian, gay and reproductive technology kinship studies. Sarah Franklin notes that 'amid the many transformations that have reshaped the study of kinship over time, the question of the significance of biological facts has remained a persistent quagmire – as easy to fall into as it is difficult to leave behind' (2001: 302).

I want to focus now on analyses of reproductive technologies in so far as these technologies challenge public imaginations of kinship, especially in cases of intergenerational gestation, genetically related egg and/or sperm donation, and non-genetically related egg and/or sperm donation. I will argue that in unintended ways, chimerism and mosaicism work in

tandem with reproductive technologies to challenge Euro-North American understandings of kinship.

Reproductive technologies offer a number of challenges to the traditionally constructed linear equation of sexual reproduction: that heterosexual coitus leads to pregnancy which leads to offspring of direct kin relation to her/his parents. In the first instance, as Franklin observes, for the 'growing number of couples . . . [for whom] coitus *never* results in pregnancy, or for whom even conception and implantation do not result in pregnancy, the usefulness of the "biological model" is . . . in question' (1997: 64). For sub-fertile or infertile heterosexual individuals, coitus very rarely results in pregnancy. Moreover, in the majority of cases where reproductive technologies are used, conception and implantation of embryos also does not result in pregnancy. So right from the start, traditional understandings of kinship fall far short of the reality for many heterosexual people, as well as lesbian and gay people. Add to this the growing use of sperm and egg donation, and the traditional understanding of kinship is further challenged.

In the case of reproductive technologies, a woman who uses egg donation might gestate and give birth to a child she has no genetic relationship with (or more specifically, no genetic relationship through her egg). Or a woman who uses the egg of her own mother might give birth to a child who is, genetically speaking, her sister and her daughter. The list of variations goes on (see Thompson, 2001). In each of these cases, we might argue that kinship is *extended* beyond traditional 'criteria' to include more than the person who gives birth to a child and her partner (i.e. to include egg donor, sperm donor and so on).

Carlos Novas and Nikolas Rose observe that 'new reproductive technologies have split apart categories that were previously coterminous – birth mother, psychological mother, familial father, sperm donor, egg donor and so forth – thus transforming the relations of kinship that used to play such a fundamental role in the rhetorics and practices of identity formation' (2000: 490–1). As Charis Thompson observes, 'biological motherhood is becoming something that can be partial' (2001: 175). In short, reproductive technologies invite such emotive concern from the public because these technologies demonstrate that biogenetics underdetermines kinship, in so far as kinship is defined as both primordial and immutable. In this way, just as anthropologists found that 'primitive' cultures use classificatory systems, we could well argue that western cultures use these same classificatory systems, even whilst they depend upon strong notions of 'biology'. That is, we *assume* that mother and child are blood related and that children do not share germ cells with their dead siblings, but this may not be corroborated by biological evidence.

Recent research investigating chimerism and mosaicism further

confound traditional notions of embodiment. Recent studies in biology refer to chimerism as the presence of two genetically distinct cell lines in an organism. This may occur through transfusion, transplantation or inheritance. In terms of transfusion, it is becoming increasingly clear that cells traffic between foetus and mother in both directions during pregnancy, and those foetal cells continue to circulate for years in the mother after birth. This 'microchimerism' has also been found in multiply transfused recipients of blood transfusions (Nelson, 2002). Finally, chimerism may also occur through inheritance. For instance, a boy was recently born in Britain who is, genetically speaking, two people because he was formed by the fertilization of two eggs and two sperm which then fused into one embryo (Pearson, 2002). In another case, the cell and tissue blood of one boy had none of his father's chromosomes, but did have a duplicated set of one half of his mother's chromosomes (Pearson, 2002). In yet another case, a mother was discovered not to be the mother of her four children (whom she had gestated and given birth to). This woman has two populations of genetically different cells, one in her blood and the other in her gonads, and that only the cells in her gonads were transferred to her children. Mosaicism is more common than chimerism and refers to patches of tissue that differ genetically. This would result in a person having two genetically distinct cell lines on a part or parts of their body.

Like reproductive technologies, chimerism and mosaicism introduce challenging variations to traditional notions of kinship. In some cases chimerism and mosaicism produce a similar extension of kinship criteria – for instance, to never-living siblings. But sometimes they produce the opposite – these biological variations *contract* kinship such that a woman who uses her own egg, uterus and blood to produce a child might not be 'blood' or genetically related to this child. A man whose sperm is used to fertilize an egg that produces a child may not be 'blood' or genetically related to this child.

What I find so interesting about chimerism and mosaicism is that whereas public understandings of reproductive technologies are deeply imbued with concerns about tampering with 'nature', chimerism and mosaicism can be 'natural' in the sense that they need not result from human technological intervention. Chimerism and mosaicism may be viewed as 'anomalies' but they stand outside of human technological intervention even as they fundamentally challenge traditional notions of kinship. As Franklin observes, 'ideas of the natural comprise one of the most important "cultural logics" that more recent theorists of kinship and gender have sought to analyse' (1997: 57). And in analysing this 'cultural logic' we find that 'nature' and science are deployed in uncomfortably contradictory ways. What chimerism and mosaicism demonstrate is that *nature* can contradict the *cultural* assumption that children are

biologically related to their (non-adoptive) parents, at the same time that this cultural assumption is supposed to be grounded in biological explanation. It is for this reason that Franklin and McKinnon (2001) argue that the privileging of kinship rests on a tautology. Moreover, whilst the interpreter of what is 'natural', science, is imbued with characteristics of rationality and impartiality within western traditions, science may also reveal relationships where none are assumed (between living and never living siblings), and no relationship (between mother and child) where such a relationship is the foundation of kinship systems.

Boundaries – inclusions and exclusions

Science and technology enjoy an ambivalent position in the cultural imagination engendered, as sociologists have pointed out already, by anxieties about the coherence and stability of human being. And as the foregoing discussion aimed to elucidate, processes of inclusion and exclusion are at the heart of cultural configurations of kinship. These processes entail the establishment of boundaries, which serve to exclude certain notions of embodiment threatening to the human sense of self. For instance, Kath Weston asks:

> If kinship can ideologically entail shared substance, can transfers of bodily substance create – or threaten to create – kinship? Can they create – or threaten to create – other forms of social responsibility? What investment do people have in depicting the transfer of blood, organs, and sperm as sharing, giving or donation? What investment do they have in resisting such transfers (or the vehicles of transfer)? Alternatively, how do people work to construe transfers as 'signifying nothing' with respect to race, sexual contact, religious identity and so on? (2001: 153)

Just as reproductive technologies threaten established understandings of kinship, (of inclusion and exclusion) Kath Weston is arguing that science and technology offer both the promise *and* threat of new configurations of selfhood, responsibility and kinship.

Prior to the research I have outlined in this article on chimerism and mosaicism in human blood, skin cells and genes, chimerism was already courting centre-stage within research on xenotransplantation. At the launch of the joint report on xenotransplantation grafting by the British Union for the Abolition of Vivisection and Compassion in World Farming (BUAV/CIWF), one scientist warned:

> The human xenotransplantation patient will become a literal *chimera* . . . It sounds like scare-mongering, but let me assure you that the word *chimera* is being used by xenotransplantation scientists. (Quoted in Brown, 1999a: 191, my emphasis)

Xenotransplantation involves the use of non-human animal cells or organs in human animals. We may think of the concept of kinship not only in terms of intra-species inclusions and exclusions (as in the case of human animals) but also between species. Thus Weston's questions about the boundaries of kinship do not just apply to the transfers of human organ and tissue between humans, but extend to these transfers between human and non-human animals.

A great deal of boundary work is done to continually distinguish between human and non-human animals.[2] Xenotransplantation engenders public concern to the extent that it threatens to collapse notions of inter-species kinship boundaries. Donna Haraway (1997) explores this boundary collapse in her work on biogenetic relationships such as OncoMouse™ that create a specific form of genetic relationship between humans and mice (humans and mice are, of course, already genetically related. So are humans and bananas for that matter). These 'trans' relationships 'simultaneously fit into well-established taxonomic and evolutionary discourses [for instance, technological progress] and also blast widely understood senses of the natural limit' (Haraway, 1997: 56). Franklin notes that 'the ways in which humans are today connected and related through biology *undoes the very fixity that the biological tie used to represent*' (2001: 314 original emphasis).

Debates invoked by xenotransplantation are heavily dependent upon an implicit notion of the monster, in this case in terms of the 'authentic' boundaries of the self (especially here in terms of humans versus non-humans). Nik Brown states:

> The monster variably expresses: the repressed forces buried beneath the promethean purpose . . . critiques of utopian rationality and the overwhelming pace of industrial capitalism . . . the insecurities of human ontology represented in the disorder that rises from Victor's disgust at an artifice which traverses death and life, organism and machine . . . (1999b: 341)

The 'pollution' created by this 'monstrous' transgression of boundaries requires action: 'the delineation of a border, the naming of transgressors, the ritual of the purge, the subsequent restoration of a boundary' (Brown, 1999b: 342).[3]

Thus public concerns about chimerism as xenotransplantation and reproductive technologies can be understood as contemporary distillations of kinship boundary work. Xenotransplantation and reproductive technologies effectively extend traditional understandings of kinship as 'flesh and blood'. And both technologies do so through an explicit and primary use of notions of 'nature' and science; the very same notions the western concept of kinship have relied upon to define (through exclusion) itself.

As well as highlighting cultural ambivalences about the boundaries of

kinship, and the limits of human selfhood and being, public concerns about xenotransplanation and reproductive technologies reveal a selective use of biological evidence. For instance, public concerns about the 'pollution' of xenotransplantation leave out what should be a parallel discussion of the 'pollution' already in human bodies since before birth. Joost Van Loon (2000) uses symbiosis theory to argue that the parasite within the body is the ultimate 'Other', and invites a reconsideration of a politics of difference from inside the body (see also Rackham, 2000). Human bodies, like those of other animals, live in necessary trans-species symbiotic relationship.[4] As Alphonso Lingus recognizes:

> . . . human animals live in symbiosis with thousands of anaerobic bacteria – six hundred species in our mouths, which neutralize the toxins all plants produce to ward off their enemies, four hundred species in our intestines, without which we could not digest and absorb the food we ingest . . . The number of microbes that colonize our bodies exceed the number of cells in our bodies by up to a hundredfold. (1994: 167)

Concomitantly, Jami Weinstein argues, 'given the biological reality that without the constant dynamic interaction between human bodies and the autonomous bodies of other living organisms human bodies would not survive, the economy of the independent, unitary, fixed, stable, whole body becomes a fantasy (or a fiction of science)' (forthcoming: 10).

If particular relationships, such as those engendered by reproductive technologies and xenotransplantation were to be placed in a hierarchy according to the degree to which they challenge traditional understandings of kinship, then the acknowledgement of trans-species interdependence represents perhaps the apex of such a hierarchy. Moreover, however radical this conceptualization might seem to public discourses of kinship, it does not depend upon any arguments about 'new' technologies. The necessary symbiotic relationships that human animals engage in are not the result of what are usually thought of as technologies that humans have created, and so bypass arguments that are made with regard to xenotransplantation and reproductive technologies, which are erroneously seen as entirely human developed.[5] Franklin notes that there has been an overestimation of both the novelty and determinism of human technological innovation – the 'plus ça change argument . . . may well serve as an important counterweight to the overreaction that may occasion developments' such as reproductive technologies and xenotranplantation (2001: 319).

And this recognition can only serve to reinforce the sociological and anthropological argument that western notions of kinship, whilst explicitly reliant upon 'natural facts' are implicitly imbued with contradictory, unsettled, anxious and ever fracturing cultural discourses. Chimerism and mosaicism are yet further examples of biology destabilizing cultural

understandings of biology (in this case, the 'monster' turns out to be the very knowledge base, nature, which public discourses ironically use to exemplify 'the natural'). As Michael and Carter argue, 'science tends to emerge narratively as a "parasite" that disrupts the smooth circulation of practices and discourses that comprise local social identities' (2001: 12).

Conclusions

In 1954, the often uncomfortable mixture of nature and culture to delineate kinship boundaries was already evident in *Youngblood*. Now, 50 years later the ambivalence of this fusion has become much more pronounced. As Lock argues 'nature/culture boundaries are contested, and nature is called upon to do cultural "work" – that is, it participates in commentary on social life, and it forces itself, selectively, into our consciousness' (1997: 273). On the one hand, biology is more than ever inextricably linked with social construction. But on the other hand, biology is taken as an ontology that exists independent of cultural constructions. The public debates we witness concerning reproductive technologies and xenotransplantation testify to the difficulty of traversing these complex relationships. Biological 'facts' are 'not as self-evident as they might appear' (Franklin, 2001: 304), and cultural notions of kinship are constantly challenged to keep up with both scientific 'discoveries' and lived experience.

Chimerism and mosaicism, as yet other scientific 'discoveries' that propel questions about culturally established kinship relations, highlight the complexity of relations between nature, science and culture. As this article has sought to illustrate, chimerism, as xenotransplantation, challenges traditional kinship boundaries between human and non-human animals. Chimerism and mosaicism, as blood, skin-cell and/or genetic genealogy, dramatically challenge the most powerful and enduring of cultural constructions of kinship relations, that between mother and child. As with new reproductive technologies, science here does not reinforce cultural ideology, but offers instead a remarkable challenge. I am certainly not arguing that chimerism and mosaicism are phenomena well known to the public, nor am I arguing that chimerism and mosaicism pervade all 'blood' and genetic relations (although the available research clearly indicates that they are much more common than first thought). But, as uncontested 'natural' phenomena, in the crucial sense that they do not involve 'human' technology, chimerism and mosaicism do not reify the expected linear relationship between the 'natural' world, science and culture. That is, scientific knowledge of chimerism and mosaicism does not confirm the cultural expectation that traditional boundaries between kin and non-kin will be reified. Nor do chimerism and mosaicism reinforce the heterosexuality of these traditional boundaries. Brown and Michael point

out that 'publics and the media are exposed to a version of science that most practising scientists would not recognise. That is, a science stripped of its nuance, uncertainty and richness' and that 'it would take a vault of spectacular dimensions to imagine that science might, in fact, benefit if its uncertainties were laid bare to public scrutiny on a more transparent basis' (2001: 280).

In many ways, the uncertainties of scientific understandings of 'nature' are realized in the seemingly constant shifts that the public experiences in scientific 'discovery' and technological innovation. Developments in reproductive technologies and chimerism (as xenotransplantation and as blood and genetic genealogy), represent, for the public at least, a constant (and often uncomfortable) reminder that heteronormative notions of kinship are subject to change. I am certainly not arguing that science (or nature for that matter) is purposefully at the vanguard of the challenges to cultural kinship ideology. It is worth noting here that biologists are not (at least in the studies I have described here) directly interested in questions of kinship. Moreover, 'scientific notions of identity do not necessarily displace the social categories of "race", class and gender' (Fraser, 1999/2000: 56). Nonetheless, these studies are of much interest to social scientists concerned with how 'nature' is used within the public imagination. Butler notes that it is 'only from a self-consciously denaturalised position [that] we can see how the appearance of naturalness is itself constituted' (1990: 110). Kinship, like an increasing number of cultural constructs, may indeed, as Schneider argues (1980[1968]), become whatever new facts about biogenetic relationships say it is, but these 'new facts' will always be filtered through a set of powerful cultural discourses.

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Notes

1. I thank the reviewers of this article for making this point.
2. Social scientists tend to homogenize non-human species. For instance, contemporary social constructionist theory owes much to George Mead's theory of symbolic interactionism. Mead (1934) distinguished humans from all other animals through our supposedly unique ability to recognize ourselves as objects. Yet, recent studies conclude that chimpanzees and orang-utans recognize themselves, and subordinate simians hide copulation from dominant males (Margulis and Sagan, 1997). Language is another trait that human animals favour in distinguishing themselves as entirely unique and (usually) superior. However, all non-human animals communicate – indeed, the recent discovery of symbolic communication by honeybees 'upsets the

very foundation of behavior, and biology in general' (Griffin in Margulis and Sagan, 1995: 150). The homogenization of non-human animals is an attempt to shift attention away from the fact that humans share 98 per cent of the same genes with chimpanzees; and if so, to what effect does such a taxonomy work? As Sarah Franklin notes 'trading organismic distinction for pan-species genetic information flow pulls the rug out from under the sex/gender system as we know it' (1995: 69), see Hird (2002).

3. As Brown also observes, 'how can we be so morally different if we're so physically similar' (1999a: 191)?
4. Donna Haraway provides a superb example of trans-species symbiosis that may usefully inform key feminist debates about embodiment. Haraway describes *Mixotricha paradoxa*, a minute single-celled organism that lives in the gut of the South Australian termite. This tiny organism engenders key questions about the autonomy of identity (we tend to assume that single organisms are defined by the possession of nucleated cells), or as Haraway puts it 'the one and many' (2001: 82). *Mixotricha paradoxa* lives in a necessary symbiotic relationship with five other organisms, none with cell nuclei but all with DNA. Some live in the folds of the cell membrane, whilst others live inside the cell, whilst simultaneously not being completely part of the cell. Haraway asks: 'is it one entity or is it six? But six is not right either because there are about a million of the five non-nucleated entities for every one nucleated cell. There are multiple copies. So when does one decide to become two? And what counts as *Mixotricha*? Is it just the nucleated cell or is it the whole assemblage?' (2001: 82. See also Hird, 2002; Rackham, 2000).
5. Approaches that insist technology is the creation and purview of human animals are simply naïve: 'we never invent anything that nature hasn't tried out millions of years earlier' (Clarke, 2000: 333). Life itself is, and has always been, 'technological' in the very real sense that bacteria, protoctists and animals incorporate external structural materials into their bodies (Margulis and Sagan, 1997). If, for instance, gene-splicing to create more socially desirable human beings is ever actualized, bacteria will have, by millions of years, beaten us to it by encouraging genes to cross species barriers. Current controversy over the use of animal cell and organ 'donation' (no one, as far as I know, has ever asked the pigs for their consent) is old hat for bacteria. The equivalent to this bacterial ability in human animals would be a man with red hair and freckles waking up, after a swim with his brunette boyfriend and dog, with brown hair, a tail and floppy ears (Margulis and Sagan, 1997: 53). Much of human engineering, whether industrial or genetic, is borrowed, not invented: bacteria long ago cornered the market on 'trans', whether transduction or transfection. For a more detailed discussion see Hird (2003a).

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